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REMARKS

Entry of this Amendment is proper because it narrows the issues on appeal and does not require further searching by the Examiner.

Claims 1, 5, 31, 34, 37-38, 40-47, 49, 53 and 57-59 are all the claims presently pending in the present Application. Claims 1, 5, 31, 34, 37, 40-43, 45-47, 49, 53 and 57-58 have been amended to more particularly define the claimed invention.

It is noted that the amendments are made only to more particularly define the invention and not for distinguishing the invention over the prior art, for narrowing the scope of the claims, or for any reason related to a statutory requirement for patentability. It is further noted that, notwithstanding any claim amendments made herein, Applicant's intent is to encompass equivalents of all claim elements, even if amended herein or later during prosecution.

Claims 1, 5, 31, 34, 37-38, 40-43, 45-47, 49, 53, 58 and 59 stand rejected under 35 U.S.C. §103 (a) as being allegedly unpatentable over Yau et al. (US Patent No. 6,054,379) in view of Allada et al. (6,218,317 B 1) and further in view of the Alleged Admitted Prior Art (AAPA).

Claims 1, 44 and 57 stand rejected under 35 U.S.C. §103 (a) as being allegedly unpatentable over Huang et al. (US Patent No. 6,352,918) in view of Allada and the Alleged Admitted Prior Art (AAPA), and further in view of Jeong (U. S. Patent No. 5,960,317).

These rejections are respectfully traversed in view of the following discussion.

I. THE CLAIMED INVENTION

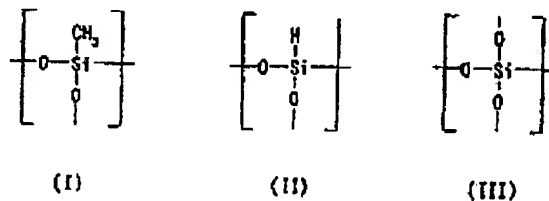
The claimed invention (e.g., as recited, for example, in claim 1 and similarly recited in claims 5, 41-42 and 49) is directed to a semiconductor device including a multi-layered insulation film formed on a semiconductor substrate, the multi-layered insulation film including a methyl silsesquioxane (MSQ) layer, a methylated hydrogen silsesquioxane (MHSQ) layer formed on and being in contact with the MSQ layer, and an inorganic insulation layer formed on and being in contact with the MSHQ layer and including a member selected from the group consisting of silicon oxide, silicon nitride and silicon oxynitride, the inorganic insulation layer including an uppermost layer of the multi-layered

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insulation film, such that the MHSQ layer inhibits a peeling away of the inorganic insulation layer. The device also includes a plurality of wires which are formed in grooves formed in the multi-layered insulation film, the MSQ layer, MHSQ layer and inorganic insulation layer of the multi-layered insulation film filling a space between the wires.

Importantly, the methyated hydrogen silsesquioxane (MHSQ) layer includes methyated hydrogen silsesquioxane (MHSQ) having repeating units shown by formulae I, II and III



, and

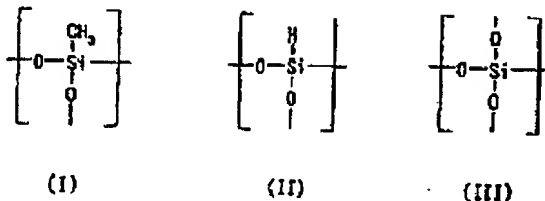
a molar ratio of II to a total of I, II and III is at least 0.5 (Application at page 16, lines 8-25).

Conventionally insulating layers may include an inorganic insulating layer (e.g., a silicon oxide layer) on an organic insulating layer. However, in devices formed by such conventional methods, during a subsequent planarizing step, peeling occurs at the interface between the organic and inorganic insulating layers, which can result in cross-talk between wires (e.g., wires which are separated by the insulating layers) in the semiconductor device (Application at Figure 5; page 2, lines 12-27; page 6, line 13 - Page 7, line 8). Other conventional insulating layers include BPSG (Application at Figure 9(b)), but BPSG has a poor gap-filling characteristic.

An exemplary aspect of the claimed invention, on the other hand, includes a methyated hydrogen silsesquioxane (MHSQ) layer which is formed on and in contact with an MSQ layer, the methyated hydrogen silsesquioxane (MHSQ) layer including methyated hydrogen silsesquioxane (MHSQ) having repeating units shown by formulae I, II and III

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, and
a molar ratio of II to a total of I, II and III is at least 0.5 (Application at page 16, lines 8-25).
This may allow the claimed invention to secure a sufficient interlayer adhesion.

II. ALLEGED PRIOR ART REFERENCES

A. Yau, Allada and the AAPA

The Examiner alleges that Yau would have been combined with Allada and the AAPA to form the invention of claims 1, 5, 31, 34, 37-38, 40-43, 45-47, 49, 53, 58 and 59. Applicant submits, however, that these references would not have been combined and even if combined, the combination would not teach or suggest each and every element of the claimed invention.

In contrast to Yau which is directed to a method of depositing an oxidized organo silane film, Allada is intended to address the problems involved with forming an undoped silicon glass (USG) hardmask on a polymer-insulated material without taking out a wafer from a spin-truck device, by producing multilayered wires in which both the hardmask and a layered insulation material are capable of being spin-coated. Further, in complete contrast to Yau and Allada, the AAPA simply teaches forming a silicon oxide film on a methyl silsesquioxane (MSQ) film 2 (Application at page 1, lines 16-21).

Thus, clearly Yau, Allada, and the AAPA have different problems and objects to be solved, and there clearly is no motivation to combine Yau, Allada, and the AAPA as alleged by the Examiner. In short, Applicant respectfully submits that these references are unrelated, and no person of ordinary skill in the art would have considered combining these disparate references, absent impermissible hindsight.

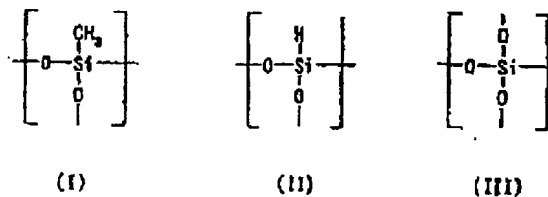
In fact, Applicant submits that the references provide no motivation or suggestion to urge the combination as alleged by the Examiner. Indeed, these references clearly do not teach or suggest their combination. Therefore, Applicant respectfully submits that one of

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ordinary skill in the art would not have been so motivated to combine the references as alleged by the Examiner. Therefore, the Examiner has failed to make a prima facie case of obviousness.

Moreover, neither Yau, nor Allada, nor the AAPA, nor any alleged combination thereof teaches or suggests "wherein said methylated hydrogen silsesquioxane (MHSQ) layer includes methylated hydrogen silsesquioxane (MHSQ) having repeating units shown by formulae I, II and III



and

wherein a molar ratio of II to a total of I, II and III is at least 0.5", as recited in claims 1, 5, 41, 42 and 49 (Application at page 16, lines 8-25). As noted above, this may allow the claimed invention to secure a sufficient interlayer adhesion.

Clearly, these features are not taught or suggested by the cited references.

Indeed, in an exemplary aspect of the claimed invention, the three layers (MSQ, MHSQ and insulation layers) may fill a space between wires or recesses (claims 1, 5, 41 and 42, see Fig. 1), or at least the MSQ layer may fill a space between gate electrodes (claim 49, see Figs. 10 and 11). The insulation layer may be positioned uppermost.

In contrast, in Fig. 10H of Yau, layers 710, 714 and 716 do not fill the space between Interconnect lines 724, and accordingly layer 714, which the Examiner attempts to equate with the MHSQ layer, lies underneath other layers 718 and 722. Hence, the peeling of the uppermost insulation layer in a device such as the claimed invention may easily occur if the MHSQ layer is not provided, as compared to layer 714 of Yau in which peeling does not easily occur even if adhesive layer 714 is not provided. Thus, it is completely unreasonable to attempt to equate the MHSQ layer of the claimed invention with layer 714 in Yau.

In addition, Yau clearly does not disclose or suggest the limitation of the MHSQ layer (a molar ratio of II to a total of I, II and III is at least 0.5) as in the claimed invention. Indeed, Yau simply teaches that the layer 714 is made of oxidized organosilane. Nowhere does Yau

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teach or suggest that layer 714 includes an MHSO layer, let alone an MHSO layer including a molar ratio of II to a total of I, II and III which is at least 0.5, as in the claimed invention.

Likewise Allada does not teach or suggest the claimed invention. In fact, Allada only discloses two-layers-structures where methylated-oxide type hardmasks are formed over polymeric interlayer dielectric material layers.

Moreover, Yau and Allada would not have been combined and even if combined, the combination would not teach or suggest each and every element of the claimed invention, because Yau and Allada have different objectives and problems to be solved.

Further, the Examiner alleges that Allada teaches "a second insulating film comprising a methylated hidrido orano siloxane polymer (HOSP)". However, Allada simply teaches using an HOSP hardmask on a polymeric interlayer dielectric. That is, nowhere does Allada teach or suggest an MHSO layer including a molar ratio of II to a total of I, II and III which is at least 0.5, as in the claimed invention. Thus, Allada clearly does not make up for the deficiencies in Yau.

Likewise, the AAPA does not teach or suggest this feature. Indeed, the AAPA makes no mention at all of these features and fails to teach or suggest of an MHSO layer including a molar ratio of II to a total of I, II and III which is at least 0.5, as in the claimed invention. Therefore, the AAPA clearly does not make up for the deficiencies in Yau and Allada.

Moreover, on page 8 of the Office Action, the Examiner expressly concedes that the "combined teachings of Yau, Allada and the prior art ... fail to expressly disclose wherein said molar ration (sic) of II to a total of I, II and III is at least 0.5". However the Examiner alleges that it would have been an obvious design choice because "applicant has not disclosed that the dimensions are for a particular unobvious purpose, produce an unexpected result, or are otherwise critical".

Applicant would direct the Examiner's attention to the present Application at page 16, lines 22-25 which states that "the molar ratio of (II) to total of (I), (II) and (III) is preferably 0.2 or more, more preferably 0.5 or more. Sufficient interlayer adhesion can be secured at the ratio in the above range". Therefore, the Examiner's allegation that "applicant has not disclosed that the dimensions are for a particular unobvious purpose, produce an unexpected result, or are otherwise critical", is clearly incorrect.

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Moreover, Applicant would remind the Examiner that the MPEP provides that "[a] particular parameter must first be recognized as a result-effective variable, i.e., a **variable which achieves a recognized result**, before the determination of the optimum or workable ranges of said variable might be characterized as routine experimentation" (MPEP at §2144.05) (emphasis added).

Here, none of the cited references recognize that the molar ratio of II to I, II and II may have any affect on securing sufficient interlayer adhesion. Therefore, it is clearly unreasonable for the Examiner to suggest that the cited references teach or suggest that the molar ratio of II to I, II and II is merely a result-effective variable.

Therefore, Applicant respectfully submits that these references would not have been combined and even if combined, the combination would not teach or suggest each and every element of the claimed invention. Therefore, the Examiner is respectfully requested to withdraw this rejection.

B. Huang and Jeong

The Examiner alleges that Huang would have been combined with Allada and the AAPA and Jeong to form the invention of **claims 1, 44 and 57**. Applicant submits, however, that these references would not have been combined and even if combined, the combination would not teach or suggest each and every element of the claimed invention.

Indeed, Applicant respectfully submits that these references are unrelated, and no person of ordinary skill in the art would have considered combining these disparate references, absent impermissible hindsight.

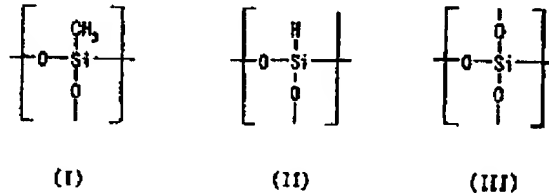
In fact, Applicant submits that the references provide no motivation or suggestion to urge the combination as alleged by the Examiner. Indeed, these references clearly do not teach or suggest their combination. Therefore, Applicant respectfully submits that one of ordinary skill in the art would not have been so motivated to combine the references as alleged by the Examiner. Therefore, the Examiner has failed to make a prima facie case of obviousness.

Moreover, neither Huang, nor Allada, nor the AAPA, nor Jeong, nor any alleged combination thereof teaches or suggests "wherein said methylated hydrogen silsesquioxane

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(MHSQ) layer includes methylated hydrogen silsesquioxane (MHSQ) having repeating units shown by formulae I, II and III



, and

wherein a molar ratio of II to a total of I, II and III is at least 0.5", as recited in claims 1, 5, 41, 42 and 49 (Application at page 16, lines 8-25). As noted above, this may allow the claimed invention to secure a sufficient interlayer adhesion.

Clearly, these features are not taught or suggested by the cited references.

Indeed, Fig. 2E of Huang (US 6,352,918) simply depicts a device including inter-metal dielectric layer 204, liner layer 208 formed on layer 204, and silicon oxide layer 210 formed on layer 208. However, Huang simply teaches that liner layer 208 "is an inorganic material or a material whose chemistry is between inorganic and organic" (column 2, lines 39-65).

Thus, nowhere does Huang teach or suggest the limitation of the MHSQ layer including a molar ratio of II to a total of I, II and III which is at least 0.5, as in the claimed invention.

Likewise, Jeong (US 5,960,317) does not teach or suggest these features.

In fact, Jeong simply discloses a method of forming electrical interconnects. Jeong is completely unrelated to the claimed invention and does not teach or suggest the claimed three-layer-structure including the limitation of the MHSQ layer. Thus, like Huang, nowhere does Jeong teach or suggest the limitation of the MHSQ layer including a molar ratio of II to a total of I, II and III which is at least 0.5, as in the claimed invention.

Therefore, neither Allada, nor the AAPA, nor Jeong make up for the deficiencies in Huang.

Therefore, Applicant respectfully submits that these references would not have been combined and even if combined, the combination would not teach or suggest each and every element of the claimed invention. Therefore, the Examiner is respectfully requested to

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withdraw this rejection.

III. FORMAL MATTERS AND CONCLUSION

In view of the foregoing, Applicant submits that claims 1, 5, 31, 34, 37-38, 40-47, 49, 53 and 57-59, all the claims presently pending in the application, are patentably distinct over the prior art of record and are in condition for allowance. The Examiner is respectfully requested to pass the above application to issue at the earliest possible time.

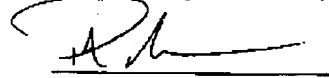
Should the Examiner find the application to be other than in condition for allowance, the Examiner is requested to contact the undersigned at the local telephone number listed below to discuss any other changes deemed necessary in a telephonic or personal interview.

The Commissioner is hereby authorized to charge any deficiency in fees or to credit any overpayment in fees to Attorney's Deposit Account No. 50-0481.

Date:

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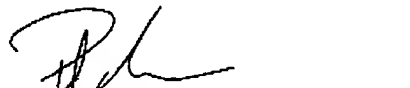
Respectfully submitted,


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CERTIFICATE OF FACSIMILE TRANSMISSION

I hereby certify that the foregoing was filed by facsimile with the United States Patent and Trademark Office, Examiner Maldonado, Julio J., Group Art Unit # 2823 at fax number (571) 273-8300 this 31st day of March, 2009.


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